

Application No. 09/972,428

NMTI 1002-4  
(747 CON 2)**REMARKS**

In the Official Action mailed 21 May 2003, the Examiner reviewed claims 1-55. The Examiner required restriction of the application to one of 3 groups, Group I consisting of claims 1-14 and 20, Group II consisting of claims 15-19 and 21-22, and Group III consisting of claims 23-55. Applicants had provisionally elected Group III, and the Examiner limited substantive examination to such claims.

The Examiner objected to the specification; and objected to claims 23-55. The Examiner rejected claims 24, 45 and 53 under 35 USC 112, first paragraph; rejected claims 23-35, 38, 45 and 53 under 35 USC 112, second paragraph; rejected claims 36-38 and 48-52 under 35 U.S.C. 102(b), and rejected claims 23, 25-27, 28-31, 33-34, 40-47 and 53-55 under 35 U.S.C. 103(a). The drawings submitted with the application are accepted by the Examiner.

Applicants have withdrawn claims 1-22, amended claims 23-25, 28-32, 35-36, 38, 44-46, 48 and 53-54, cancelled claim 27 and added new claim 56. Claims 23-26 and 28-56 are now pending.

**Restriction Requirement**

In a telephone conversation with the Examiner, attorney for applicants provisionally elected, without traverse, to prosecute the invention of Group III, claims 23-35. This election is hereby affirmed. Claims 1-22 have been withdrawn from further consideration as being drawn to non-elected inventions.

**Objection to the Specification**

The Examiner objected to the specification because of noted informalities. Applicants have amended the specification as suggested by the Examiner. Accordingly, reconsideration of the objection to the specification is requested in view of the amendments.

**Objection to Claims 23-55**

The Examiner has objected to claims 23-55 because of informalities, referring specifically to claims 23, 25, 30, 31, 36, 46, 48, and 54. These claims are amended herein

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to correct the informalities as suggested by the Examiner. Accordingly, reconsideration of the objection to claims 23-55 is requested in view of the amendments.

Rejection of Claims 24, 45 and 53 under 35 U.S.C. 112(1)

Claims 24, 45 and 53 are rejected under 35 U.S.C. 112, first paragraph.

Applicants have amended such claims, and added new claim 56, to address the issues raised. Accordingly, reconsideration of the rejection of claims 24, 45 and 53 is requested in view of the amendments.

Rejection of Claims 23-35, 38, 45 and 53 under 35 U.S.C. 112(2)

Claims 23-35, 38, 45 and 53 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite, referring specifically to claims 23, 24, 28-29, 38, 45 and 53.

Applicants have amended such claims to address the issues raised. Accordingly, reconsideration of the rejection of claims 23-35, 38, 45 and 53 is requested in view of the amendments.

Rejection of Claims 36-38 and 48-52 under 35 U.S.C. 102(b)

Claims 36-38 and 48-52 are rejected under 35 U.S.C. 102(b) as being anticipated by Spence, U.S. Pat. 5,573,890. Applicants have amended independent claims 36 and 48 to clarify that the exposing steps for the phase shifting and trim patterns use radiation characterized by a set of parameters that have substantially the same values in both exposing steps. The Examiner may have interpreted the claims to read that the set of optical parameters defining one exposing step are the same as those defining the other, even when the values of the parameters change. This potential interpretation was not intended, and the claims have been clarified.

The Spence reference describes the use of a phase shift mask exposure step followed by a trim mask exposure step, and the Examiner states that the radiation dose of the trim mask exposure "may or may not utilize the same setting ... as the first dose." However, there is no discussion in Spence whatsoever of the settings used for the optical parameters of the exposing steps for the trim mask. The Examiner's conclusion that the

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settings in Spence for the trim mask exposure "may or may not be the same" as those for the phase shifting mask exposure is pure speculation, and unsupportable on this record. In fact, Spence does not anticipate using the same settings, and Applicants claim that it would not have been obvious to those of skill in the art that the two exposure process could be set up so as to use the same settings for the optical parameters as claimed.

Claims 37 and 38 and claims 49-52, depend from claims 36 and 48 respectively, and are believed to distinguish over Spence for at least the same reasons.

Accordingly, reconsideration of the rejection of claims 36-38 and 48-52 is respectfully requested.

Rejection of Claims 23, 25-26, 28-30, 40-41, 45-46 and 53-54 under 35 U.S.C. 103(a)

Claims 23, 25-26, 28-30, 40-41, 45-46 and 53-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spence as applied to claims 36-38 and 48-52 above in view of Jinbo et al., ("0.2 $\mu$ m or Less Lithography by Phase-Shifting-Mask Technology," *IEEE* (1990) 33.3.1-33.3.4).

The Examiner relies on the Jinbo et al. reference to teach a variety of optical parameters not described in Spence. However, Jinbo et al., does not address the concept of using the same values for the set of parameters in both phase shifting and trim mask exposing steps, as recited in independent claim 23, from which claims 25, and 28-30 depend, and as recited in claims 36 and 48, as discussed above, from which claims 40-41, 45, 46 and 53-54 depend. In fact, Applicants do not find any mention in the Jinbo et al. reference of the settings for the optical parameters of the exposure apparatus that are used for a trim mask used as a complement to a phase shifting mask.

The Examiner refers to the Abstract of Jinbo et al., where it is stated that "Light intensity calculation shows that PEL gives a dark field and that its light intensity distribution is shaper (sic) those of chrome masks under the same illumination conditions." This comment however does not relate to the setting of a trim mask used in combination with a phase shifting mask. Rather, Jinbo, et al., is merely commenting that sharper images can be achieved using phase shifting than by using binary chrome masks alone. Jinbo, et al., is completely silent with regard to the engineering required for using a phase shifting mask in combination with a trim mask.

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The Examiner suggests that application of phase shift masking to "full phase" applications would be expected from a "drive toward denser and higher-speed devices." However, this suggestion that it is desirable to achieve denser and higher-speed devices is insufficient basis for concluding that the use of exposure steps involving phase shifting masks and trim masks using substantially the same settings for optical parameters would have been obvious to achieve that goal. Indeed, Jinbo, et al., states that the techniques described in their article "can be adapted to isolated patterns." There is no suggestion that these techniques can be applied to the "full phase" setting. Likewise, the Spence reference does not suggest "full phase" techniques as described and claimed in the present application. Applicants submit that the Examiner has improperly relied upon hindsight in the construction of the rejection of these claims.

Neither Spence nor Jinbo et al. suggests that the values of the optical parameters used during the phase shifting exposure step be substantially the same as the values used during the complementary trim mask exposure step. Accordingly, there is no prima facie case of unpatentability presented, and reconsideration of the rejection of claims 23, 25, 26, 28-30, 40-41, 45-46 and 53-54 is respectfully requested.

Rejection of Claims 25, 45-46 and 53-54 under 35 U.S.C. 103(a)

Claims 25, 45-46 and 53-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spence and Jinbo as applied above, and further in view of Wong et al. ("Investigating Phase-Shifting Mask Layout Issues Using a CAD Toolkit," *IEEE* (1991), 27.4.1-27.4.4). The claims referred to in this part of the official action relate to characterization of the amount of a pattern which is implemented using the phase shifting. The Examiner relies on the Wong et al. reference to suggest the application of phase shifting techniques to "full phase" type applications. However, Wong et al. fails to discuss the engineering involved in setting of optical parameters used during the phase shifting entry mask exposure steps. Accordingly, Wong et al. does not overcome the failure of the prima facie case discussed above. Accordingly, it is submitted that claims 25, 45-46 and 53-54 are patentable for at least the same reasons as the claims from which they depend, and reconsideration is requested.

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(747 CON 2)Rejection of Claims 27 and 33-34 under 35 U.S.C. 103(a)

Claims 27 and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spence and either Jinbo or Wang as applied above, and further in view of Pierrat, U.S. Pat. 6,040,892. Applicants point out that claim 27 has been canceled.

Claims 33-34 relate to the use of first and second mask patterns on a single reticle. The Examiner relies upon Pierrat, to suggest the future. However, claims 33-34 depend from claim 23 as amended, and are believed allowable for at least the same reasons. Furthermore, the combination of references relied upon by the Examiner does not suggest the combination recited in these claims. Accordingly, reconsideration of the rejection of claims 33-34 is respectfully requested.

Rejection of Claim 31 under 35 U.S.C. 103(a)

Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spence and Jinbo as discussed above, and further in view of either Pierrat or Borodovsky, U.S. Pat. 5,424,154. Claim 31 depends from claim 23 as amended, and is believed allowable for at least the same reasons. Neither Pierrat or Borodovsky suggests using substantially the same values for optical parameters during the phase shifting and trim mask steps as required by all claims in the present application. Accordingly, reconsideration of the rejection of claim 31 is respectfully requested.

Rejection of Claim 42 under 35 U.S.C. 103(a)

Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spence as discussed above in view of Borodovsky. Claim 42 depends from claim 36 as amended, and is believed allowable for at least the same reasons. As mentioned above, Borodovsky does not suggest using substantially the same values for optical parameters during the phase shifting and trim mask steps as required by all claims in the present application. Accordingly, reconsideration of the rejection of claim 42 is respectfully requested.

Rejection of Claims 43-44, 47 and 55 under 35 U.S.C. 103(a)

Claims 43-44, 47 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spence as discussed above in view of Pierrat. Claims 43-44, 47 and 55

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depend from claim 36, as amended. Claim 55 depends from claim 48, as amended.  
Thus, such claims are believed allowable for at least the same reasons as their respective base claims. Furthermore, as mentioned above, Pierrat does not provide the missing elements required by the Examiner for a prima facie case of unpatentability.  
Accordingly, reconsideration of the rejection of these claims is respectfully requested.

Allowable Subject Matter

The Examiner has indicated that claims 32 and 35 would be allowable if rewritten in independent form. Applicants have presented such claims in independent form. Thus, reconsideration of the objection to claims 32 and 35 is respectfully requested.

CONCLUSION

It is respectfully submitted that this application is now in condition for allowance.

The Commissioner is hereby authorized to charge any fee determined to be due in connection with this communication, or credit any overpayment, to our Deposit Account No. 50-0869 (NMTI 1002-4).

Respectfully submitted,

Dated: Aug 2003

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